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# Interprofessional education in problem-based learning: A frontier form of PBL in medical education

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## Abstract:

**BACKGROUND:** Interprofessional education (IPE) aims to educate healthcare students to improve collaboration and the quality of care. The delivery of IPE through a problem-based learning (PBL) setting appears to hold good validity. However, there are few studies that show the value of combining these two teaching modes.

**MATERIALS AND METHODS:** The research was a longitudinal intervention study. A total of 360 students were randomly divided into three interprofessional PBL (IPBL) groups that mixed nursing, pharmacy, and clinical medical students and three uniprofessional PBL (UPBL) groups that consisted of a single profession. An improved Attitude and Learning Ability Questionnaire (ALAQ) was used to measure the improvement in attitudes toward interprofessional cooperation and learning outcomes. The tutorial session and final examination grades were compared between IPBL and UPBL by Chi-square tests and Cochran–Mantel–Haenszel tests. Cronbach's  $\alpha$  analysis was calculated to assess the validity and reliability. Cronbach's alpha coefficient of the questionnaire was 0.887, demonstrating high levels of reliability (95% confidence interval [CI]: 0.842 0.916).

**RESULTS:** According to Chi-square tests and Cochran–Mantel–Haenszel tests, we observed the student's positive attitudes toward interprofessional collaboration and the student's role awareness in the IPBL students was increased compared with UPBL students. In addition, a great majority of IPBL students felt that they had improved their self-learning ability and maintained a high enthusiasm for learning during the course.

**CONCLUSION:** Our study found that the IPBL teaching model was more effective than the UPBL teaching model in healthcare student's positive attitudes toward interprofessional collaboration and learning outcomes.

## Keywords:

Interprofessional collaboration, interprofessional education, interprofessional problem-based learning (IPBL), problem-based learning, uniprofessional problem-based learning (UPBL)

## Introduction

The Center for the Advancement of Interprofessional Education (CAIPE) defines interprofessional education (IPE) as "occasions when two or more professions learn with, from, and about each other to improve collaboration and the quality of care and services".<sup>[1]</sup> The World Health Organization's (WHO) *Framework for Action*

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on *Interprofessional Education and Collaborative Practice* facilitates the implementation of IPE and collaborative practice around the world.<sup>[2,3]</sup> Individuals and organizations use many different titles to describe IPE, including common learning, shared learning, and collaborative education.<sup>[4-6]</sup> Many studies have examined the benefits of interprofessional interventions in health care. It is claimed that healthcare students who learn together will be better prepared

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for contemporary practice and more able to work collaboratively and communicate effectively.<sup>[7-10]</sup>

Currently, more and more individuals and organizations are showing strong interest in IPE. Many organizations and countries have begun to invest heavily to support IPE in health professions and have achieved good outcomes.<sup>[11-14]</sup> Problem-based learning (PBL) is an effective and satisfactory methodology for medical education and has been widely used and reported in many fields of undergraduate education.<sup>[15-17]</sup> Both PBL and IPE are well-recognized concepts within medical education that have been extensively evaluated and reviewed.<sup>[18-20]</sup>

However, there are few studies that show the value of combining these two teaching modes. Firstly, the new teaching strategy of interprofessional PBL (IPBL) was required to measure the feasibility and learning outcomes in China. Furthermore, to identify the advantages of IPBL in effective teaching mode which enhances vocational awareness, teamwork, and promotes self-learning in Chinese undergraduate medical care students. To achieve this aim, IPBL was implemented and compared with UPBL in basic medical sciences at Peking University.

## Materials and Methods

### Study design and setting

This study was an intervention study of 360 clinical medicine, pharmacy, and nursing students enrolled in basic medical sciences at Peking University. The participants were recruited from student volunteers. They attended information sessions regarding the type of study and time commitment. Participants stated the time commitment they could afford and were subsequently randomly assigned to one of two tutorial groups in an immunology–hypersensitivity course: IPBL, combining two teaching methods of IPE and PBL, and UPBL, entailing a PBL teaching pattern with no IPE elements. Each group had 10 students, with 36 groups in total. Tutors with strong experience in PBL courses were chosen and randomly assigned to one IPBL and one UPBL as a control group. We performed the studies three times from three groups of students in three spring semesters, respectively.

### Study participants and sampling

Three groups of students, respectively, from three spring semesters have not taken the PBL course before. The case was called the “Wounded Angel” and described a clinical event about a young lady with a selective IgA deficiency. The immunology–hypersensitivity module profiled in this study was a 2-week block course one time a week and two hours at a time, and the students remained with the same tutor throughout the entire block. The students

and faculty staff involved in the module were given the opportunity to ask questions at all times. Students mainly requested information pertaining to grading. They were informed that the learning assessment form or their answers to the research questionnaire were not affected by pass grades, which were only affected by attendance and the quality of delivered essays.

### Data collection tool and technique

We designed an Attitude and Learning Ability Questionnaire (ALAQ) to assess the effectiveness of the IPBL curriculum. This questionnaire was constructed using evidence from literature,<sup>[21,22]</sup> the views of practitioners and academics, and traditional Chinese medical culture.

The study instrument consisted of five sections. The first section collected demographic information such as sex, student group (clinical medicine, nursing, or pharmacy), age, and previous experience in a healthcare setting. The next three sections concerned the three subscales of the ALAQ. Section 2 focused on items concerning the roles and responsibilities of medical professionals, including awareness of group membership, evaluation, and affect (five items). Statements in Section 3 concerned teamwork and collaboration (seven items). Section 4 related to the self-evaluation of learning enthusiasm and self-learning ability in IPE, that is, “motivation and self-learning ability” (six items). The fifth section involved an outcome analysis of student grade. A five-point Likert scale was used to record responses to the 18 items, ranging from “5 = strongly agree” to “1 = strongly disagree.” Students had to indicate the extent to which they agreed or disagreed with a range of statements. Students who did not complete or return the questionnaire were considered nonresponders.

### Statistical analysis

The data were analyzed using SAS version 9.1 software. Chi-square tests and Cochran–Mantel–Haenszel tests were used to observe differences among groups, and the frequencies of responses in each group were also counted. All the results were considered significant at  $P < 0.05$ .

### Ethical consideration

Informed consent was obtained from all participants. This study was conducted with the approval of the Ethics Committee of Peking University Health Science Center.

## Results

A total of 360 students completed the questionnaire, representing an overall response rate of 100%. Table 1 shows the students’ demographic characteristics, with 180 students in the IPBL groups and 180 in the UPBL

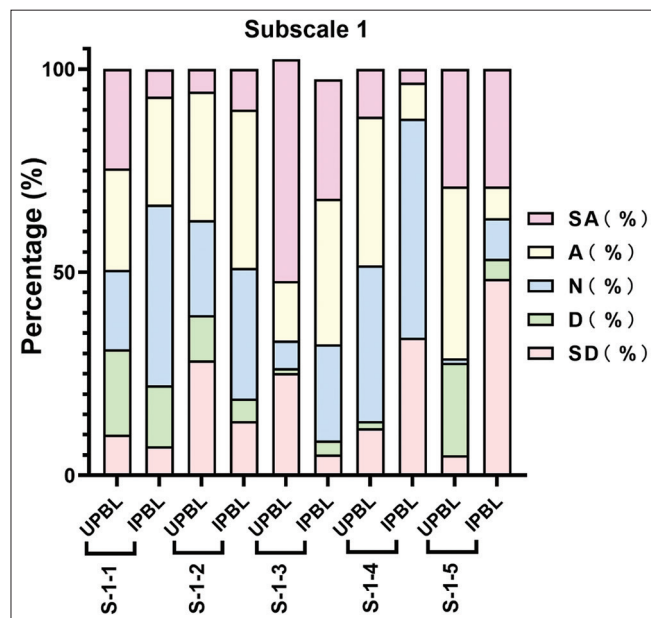
groups. There were more females than males in the sample (female = 59.4%), and the mean age ranged from 19.4 to 19.7 years. No differences were seen among the characteristics of the groups. All students reported that they had no previous experience in IPBL or UPBL [Table 1].

### Subscale 1: Roles and responsibilities

The items in the roles and responsibilities scale mainly concerned students' attitudes to the roles and responsibilities in health professional practice [Table S1 and Figure 1].

24.44% of UPBL students strongly agreed that "the function of nurses and therapists is mainly to provide support for doctors." However, only 6.66% of IPBL students strongly agreed with this statement. The main reason for this phenomenon is the difference in clinical medical students' attitude. 28.33% of clinical

medical students in UPBL agree with this statement, while only 3.33% of clinical medical students are in IPBL. Compared with nursing and pharmacy students in the other UPBL groups, only a small proportion of clinical medical students (3.33%) strongly agreed that they were not sure what their professional role would be. However, 1.67% of clinical medical students in IPBL strongly agreed with this statement. 54.6% of UPBL students strongly agreed that doctors should assume the greatest share of responsibility if a medical incident occurs; however, only 29.44% of students strongly agreed with this statement in IPBL. Opinions varied regarding a statement that suggested that the nurses had the easiest job in the hospital. In UPBL, 11.66% of students strongly disagreed with this statement. In contrast, 33.9% of IPBL students strongly disagreed with the statement. 5% of UPBL clinical medicine students strongly disagreed with this view that the role of pharmacists is insignificant, and that they should bear no responsibility should medical malpractice occur, and 24.17% of students strongly disagreed with the statement in IPBL.



**Figure 1:** Roles and responsibilities. This section consists of five parts, including S-1-1 to S-1-5. S-1-1 shows that the function of nurses and therapists mainly to provide support for doctors. S-1-2 shows that I am not sure what my professional role will be. S-1-3 shows that if a medical incident occurs, doctors should assume the most responsibility. S-1-4 shows that I think that the easiest job in the hospital is the nurses' job. S-1-5 shows that I think that the role of pharmacists is insignificant, they should bear no responsibility when medical malpractice occurs. SA = strongly agree, A = agree; N = neutral; D = disagree; SD = strongly disagree

### Subscale 2: Teamwork and collaboration

The items in subscale 2 concerned attitudes toward teamwork and effective collaborative teamwork strategies in different health professional groups. High scores reflect more favorable attitudes [Table S1 and Figure 2].

A high proportion of students from all groups showed positive responses to shared learning with other professions. Most students agreed or strongly agreed that "patients ultimately benefit if healthcare professionals work together to solve patient problems" and acknowledged the importance of respect and seeking help from other professionals. Most students took the view that shared learning would help them understand their own limitations or communicate better with patients and other professionals and that all healthcare professionals must learn teamwork skills. However, the results also show that in UPBL, the score for clinical medical students was significantly lower than that of nursing students. There was no statistically significant difference between nursing and pharmacy students. Furthermore, there was an obvious improvement in overall attitudes toward collaboration in IPBL [Table S1 and subscale 2]. The results show that there

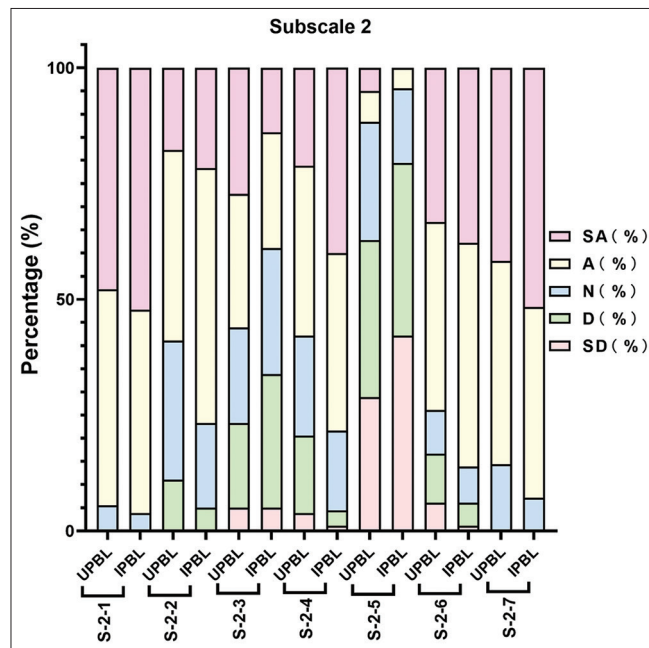
**Table 1: Characteristics of the groups in IPBL and UPBL**

	IPBL-1	IPBL-2	IPBL-3	UPBL-(1-3)	P for difference
Age ( $\bar{x} \pm s$ )	19.6±1.6	19.5±1.4	19.4±1.3	19.7±1.4	0.71323
Male (%)	36.7	43.3	40.0	41.1	0.8966
Female (%)	63.3	56.7	60.0	58.9	
Clinical medical students (%)	30.0	40.0	30.0	33.3	0.7306
Nursing students (%)	40.0	30.0	30.0	33.3	
Pharmacy students (%)	30.0	30.0	40.0	33.3	
Previous experience in PBL or UPBL (n)	0	0	0	0	

were four statements regarding positive teamwork that produced statistically significant differences between UPBL and IPBL, especially between clinical medical students in IPBL and UPBL.

### Subscale 3: Motivation and self-learning ability

The items in this scale deal with issues around the statement “motivation and self-learning scale are based on students’ self-identity” [Table S1 and Figure 3]. Most students actively participated in the discussions and attempted to obtain further knowledge to support their arguments. No significant statistical differences were found between UPBL and IPBL. However, the analysis also revealed significant differences in the items “I can acquire the learning objectives more smoothly through the case discussion” and “I become more adept at gathering information from multiple channels and I can evaluate the value of this information more objectively” between the same healthcare professional students in different groups: Students in IPBL had consistently higher scores than those in UPBL. Nursing students in IPBL were the group most likely to agree with “shared learning will increase my ability to express and communicate” and “after group discussion, I found my ability to analyze and solve problem had improved.”



**Figure 2:** Teamwork and collaboration. This section consists of seven parts, including S-2-1 to S-2-7. S-2-1 shows that patients ultimately benefit if healthcare professionals work together to solve patient problems. S-2-2 shows that shared learning with other professions will help me understand my own limitations. S-2-3 shows that I don't know how to deal with the relationship between different medical professions. S-2-4 shows that respect and seeking help from the other profession are very important in healthcare. S-2-5 shows that I don't want waste my time learning with other healthcare students. S-2-6 shows that shared learning with other healthcare professionals will help me to communicate better with patients and other professionals. S-2-7 shows that team-work skills are essential for all healthcare professionals to learn. SA = strongly agree; A = agree; N = neutral; D = disagree; SD = strongly disagree

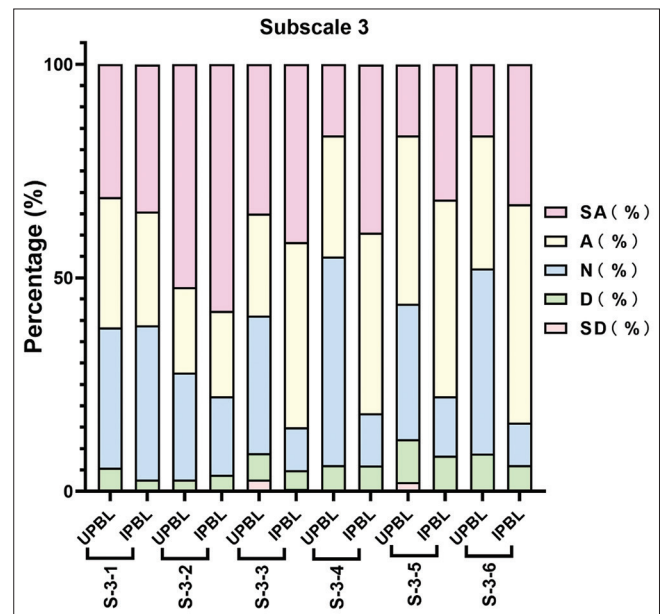
### Outcome analysis of grades

To compare IPBL and UPBL regarding the “immunology–hypersensitivity” knowledge they mastered before and after the course, we designed some questions for the final test. The questions accounted for 25% of the total points.

Cochran–Mantel–Haenszel tests showed no statistical difference between IPBL and UPBL in tutorial or final examination. In addition, there were no statistically significant differences in the proportions of students who achieved honors/pass/fail grades between those in IPBL and UPBL for the outcome measures. As with UPBL, the IPBL process plays the same role in helping students recognize the value of knowledge and skills in analyzing medical problems in immunology [Table 2].

### Discussion

The study sample of 360 healthcare students accounted for close to 40% of the clinical medicine, nursing, and pharmacy students enrolled at the institution. The sample size was relatively small because of the difficulties of implementing IPE; compared with the general teaching test size in China, this was acceptable. The return rate of 100% ( $n = 360$ ) was high. This is encouraging and should provide a high level of confidence in the robustness of



**Figure 3:** Motivation and self-learning ability. This section consists of six parts, including S-3-1 to S-3-6. S-3-1 shows that during whole curriculum, I have always actively participated in the discussion, full of passion and interest. S-3-2 shows that in order to participate more effectively in the discussion, I should acquire further knowledge to find evidence to support my opinion. S-3-3 shows that I can acquire learning objectives more smoothly through case discussions. S-3-4 shows that I will become more adept at gathering information from multiple channels and I can evaluate the value of this information more objectively. S-3-5 shows that shared learning will increase my ability to express and communicate. S-3-6 shows that after group discussion, my ability to analyze and solve problem was improved. SA = strongly agree; A = agree; N = neutral; D = disagree; SD = strongly disagree



**Table 2: Outcome analysis of grades**

Statements	Student group	Percent rating (%)			P
		Honors	Pass	Fail	
Tutorial session grades	UPBL	4.72	45.28	0.00	0.7257
	IPBL	5.28	44.72	0.00	
Final examination grades	UPBL	4.71	42.35	2.06	0.3127
	IPBL	4.41	42.65	3.82	

the results. The findings from this study have provided first-hand data for planning interprofessional learning strategies within basic medicine at Peking University. Our results indicate that most healthcare students are positive about the benefits of shared learning. The results also demonstrate that key differences were found between the healthcare professionals in UPBL and IPBL.

In our study, clinical medical students have a stronger professional identity compared with nursing students. It must be noted that, traditionally, China’s medical education places the physician in the leadership position within a medical team, to determine all medical diagnoses and treatments, and that the main function of other professionals is to obey doctors’ orders and implement treatments. This perception may be a possible barrier toward the effective implementation of IPBL and may influence patient safety when clinical medical students become employed. Respect and trust toward colleagues are important to reduce the likelihood of medical malpractice.

Interprofessional communication in health care is associated with improved quality of care and patient outcomes, and vice versa.<sup>[23,24]</sup> The students in IPBL are more likely to have respect for the jobs of others: pharmacists and nurses. Thus, it would seem that the IPBL teaching strategy provided clinical medical students the opportunity to alter their attitudes that they have preeminence over other healthcare students. Nursing and pharmacy students consider that clinical medical students should respect their value and listen and share information with them, so that they may in return willingly cooperate with directions.

Compared with clinical medical students in UPBL, IPBL clinical medical students showed some significant changes in their attitudes to shared learning. Those in IPBL are more aware of personal limitations, are willing to seek help when necessary, and respect the integrity and contribution of others. The same situation was found in nursing and pharmacy students, indicating that team spirit is learned more effectively with students from other healthcare disciplines.

Students in IPBL from different professions showed greater consistency in their attitude toward the statement “team-work skills are essential for all healthcare

professionals to learn.” Most consider that IPBL can promote their ability to work as a team member, raise awareness and respect for the roles of team members, and help them communicate better with other professionals and acquire further skills to deal with relationships among different medical professions. Furthermore, we also found that the majority of students expressed that the period of shared learning with other professions was fun and stimulating, and they suggested implementing such courses more often. Some students, however, were frustrated and did not contribute to any discussions during the course—these students merely wanted to understand the course content but did not contribute. Some students also felt nervous studying with students from other disciplines. Therefore, greater attention needs to be paid toward creating a welcoming and nonintimidating environment.

The motivation and self-learning ability of the students are also significant factors in assessing the learning outcomes of a curriculum and should be considered in future studies. Our study shows that with or without IPE, the students in both groups displayed high levels of enthusiasm for learning. Compared with UPBL students, IPBL students strongly felt that they improved their ability to acquire learning objectives, gather information, and the ability to communicate with others and solve problems. To convince other professional colleagues how to better support their points of view and to show their ability, further research is required to identify useful information and communication strategies. Every profession has its own expertise, and through shared learning with other professions, professionals can obtain further opportunities to learn from colleagues and access resources to resolve problems. Shared learning can substantially improve the efficiency of discussion.

This study relied on voluntary participation, and as such, the study sample cannot be considered to be a truly representative sample of healthcare professional students. Those who participated may have been more inclined toward a positive attitude about collaborative practice and IPBL even before the interventions, relative to those who declined to participate. However, such a limitation is inherent in studies in which a random selection of participants is not feasible.

**Limitation and recommendation**

In this work, we performed the studies three times from student volunteers in three consecutive spring semesters. The relative sample size was the limitation of the present study. Thus, there is a need to encourage more students from various courses to participate in the study and expand the sample size. Moreover, the study was conducted only among the students who came from compulsory courses, and the results could

be generalized to other types of courses. Importantly, we herein proposed “IPBL,” which provided a novel organization to improve PBL.

## Conclusion

Assessing the attitudes of learners and their learning outcomes is important to develop IPBL strategies. This study provides the first baseline data on attitudes and learning of healthcare students from three health professions. Our study has proved that the IPBL teaching process is more effective in some respects than UPBL strategies.

Our findings have shown that overall clinical medicine, nursing, and pharmacy students have favorable attitudes to IPE. This is encouraging if administrators wish to introduce and implement IPBL in the undergraduate curriculum and thus be in line with current trends in healthcare education. IPBL is also suitable for students in Chinese medical schools as it goes beyond differences in culture and healthcare systems. A specifically designed case including interprofessional elements is required in IPBL practice. It was also shown in this study that some students had a low level of participation and poor attitudes toward teamwork. This should be investigated further to describe and understand their needs and the factors that influence their attitudes.

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## Practice points

- IPBL teaching module plays a good role in enhancing awareness of professional responsibilities, adopting a positive teamwork attitude, and improving medical care students’ self-directed learning ability.
- IPBL teaching process is more effective in some respects than UPBL.
- IPBL is also suitable for students in Chinese medical schools as it goes beyond differences in culture and healthcare systems.

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## Conflicts of interest

The authors declare no conflicts of interest.

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**Table S1: Results from the Attitude and Learning Ability Questionnaire (ALAQ)**

Subscales/statements	Professional	Group	Percent rating (%)					P
			SD	D	N	A	SA	
Subscale 1: Roles and responsibilities								
1-1. The function of nurses and therapists mainly to provide support for doctors	Clinical medicine	UPBL	0.00	0.00	2.50	19.17	28.33	<0.0001
		IPBL	3.33	7.50	20.83	15.00	3.33	
	Nursing	UPBL	13.33	26.67	5.83	2.50	1.67	
		IPBL	3.33	8.33	22.50	13.33	2.50	
	Pharmacy	UPBL	1.67	5.00	20.83	15.83	6.67	
		IPBL	4.17	6.67	23.33	11.67	4.17	
1-2. I am not sure what my professional role will be	Clinical medicine	UPBL	4.17	1.67	18.33	22.50	3.33	<0.0001
		IPBL	1.67	1.67	24.17	20.83	1.67	
	Nursing	UPBL	17.50	6.67	10.83	12.50	2.50	
		IPBL	13.33	2.50	8.33	19.17	6.67	
	Pharmacy	UPBL	20.83	8.33	5.83	12.50	2.50	
		IPBL	5.00	4.17	15.83	18.33	6.67	
1-3. If a medical incident occurs, doctors should assume the most responsibility	Clinical medicine	UPBL	12.50	0.00	4.17	5.83	27.50	<0.0001
		IPBL	2.50	1.67	10.83	15.83	19.17	
	Nursing	UPBL	11.82	0.00	2.73	12.73	27.27	
		IPBL	2.73	0.00	15.45	20.91	6.36	
	Pharmacy	UPBL	13.56	1.69	3.39	3.39	27.12	
		IPBL	2.54	3.39	9.32	16.95	18.64	
1-4. I think that the easiest job in the hospital is the nurses' job	Clinical medicine	UPBL	0.00	0.00	16.67	26.67	6.67	0.2316
		IPBL	16.67	0.00	24.17	7.50	1.67	
	Nursing	UPBL	16.67	0.00	27.50	4.17	1.67	
		IPBL	19.17	0.00	29.17	1.67	0.00	
	Pharmacy	UPBL	0.83	2.50	13.33	24.17	9.17	
		IPBL	15.00	0.00	27.50	4.17	3.33	
1-5. I think that the role of pharmacists is insignificant, they should bear no responsibility when medical malpractice occurs	Clinical medicine	UPBL	5.00	9.17	1.67	23.33	10.83	<.0001
		IPBL	24.17	5.83	5.00	5.00	10.00	
	Nursing	UPBL	1.67	15.00	0.00	15.83	17.50	
		IPBL	20.83	1.67	2.50	3.33	21.67	
	Pharmacy	UPBL	0.83	10.00	0.00	24.17	15.00	
		IPBL	27.50	0.00	7.50	3.33	11.67	
Subscale 2: Teamwork and collaboration								
2-1. Patients ultimately benefit if healthcare professionals work together to solve patient problems	Clinical medicine	UPBL	0	0	4.17	29.05	22.5	<.0001
		IPBL	0	0	1.64	29.17	19.17	
	Nursing	UPBL	0	0	1.67	19.59	22.5	
		IPBL	0	0	1.67	18.5	30.83	
	Pharmacy	UPBL	0	0	2.5	21.35	26.67	
		IPBL	0	0	2.5	18.17	28.33	
2-2. Shared learning with other professions will help me understand my own limitations	Clinical medicine	UPBL	0.00	10.00	16.67	16.67	6.67	<0.01
		IPBL	0.00	3.33	9.17	27.50	10.00	
	Nursing	UPBL	0.00	3.33	15.00	23.33	8.33	
		IPBL	0.00	1.67	10.00	27.50	10.83	
	Pharmacy	UPBL	0.00	3.33	13.33	21.67	11.67	
		IPBL	0.00	2.50	8.33	27.50	11.67	
2-3. I don't know how to deal with the relationship between different medical professions	Clinical medicine	UPBL	1.67	4.17	12.50	19.17	12.50	<0.01
		IPBL	2.50	10.00	15.83	14.17	7.50	
	Nursing	UPBL	3.33	13.33	8.33	11.67	13.33	
		IPBL	2.50	20.83	10.00	10.00	6.67	
	Pharmacy	UPBL	2.50	10.00	10.00	12.50	15.00	
		IPBL	2.50	12.50	15.00	13.33	6.67	

Contd...



**Table S1: Contd...**

Subscales/statements	Professional	Group	Percent rating (%)					P
			SD	D	N	A	SA	
2-4. Respect and seeking help from the other profession are very important in health care	Clinical medicine	UPBL	2.50	15.00	11.67	15.83	5.00	<0.001
		IPBL	1.67	1.67	8.33	22.50	15.83	
	Nursing	UPBL	1.67	5.00	10.00	20.83	12.50	
		IPBL	0.00	1.67	5.83	15.83	26.67	
	Pharmacy	UPBL	1.67	5.00	10.83	18.33	14.17	
		IPBL	0.00	1.67	11.67	19.17	17.50	
2-5. I don't want waste my time learning with other healthcare students	Clinical medicine	UPBL	9.17	18.33	12.50	5.83	4.17	<0.001
		IPBL	18.33	15.00	13.33	3.33	0.00	
	Nursing	UPBL	19.17	15.00	13.33	1.67	0.83	
		IPBL	27.50	17.50	5.00	0.00	0.00	
	Pharmacy	UPBL	15.00	17.50	12.50	2.50	2.50	
		IPBL	17.50	23.33	5.83	3.33	0.00	
2-6. Shared learning with other healthcare professionals will help me to communicate better with patients and other professionals	Clinical medicine	UPBL	5.83	10.00	5.00	18.33	10.83	<0.01
		IPBL	1.67	4.17	6.67	29.17	8.33	
	Nursing	UPBL	1.67	2.50	4.17	23.33	18.33	
		IPBL	0.00	0.83	1.67	18.33	29.17	
	Pharmacy	UPBL	1.67	3.33	5.00	19.17	20.83	
		IPBL	0.00	2.50	3.33	25.00	19.17	
2-7. Team-work skills are essential for all healthcare professionals to learn	Clinical medicine	UPBL	0.00	0.00	10.83	25.83	13.33	<0.05
		IPBL	0.00	0.00	3.33	22.50	24.17	
	Nursing	UPBL	0.00	0.00	4.17	20.00	25.83	
		IPBL	0.00	0.00	2.50	16.67	30.83	
	Pharmacy	UPBL	0.00	0.00	6.67	20.00	23.33	
		IPBL	0.00	0.00	5.00	22.50	22.50	
Subscale 3: Motivation and self-learning ability								
3-1. During whole curriculum, I have always actively participated in the discussion, full of passion and interest	Clinical medicine	UPBL	0.00	1.67	16.67	18.33	13.33	0.5641
		IPBL	0.00	0.00	18.33	12.50	19.17	
	Nursing	UPBL	0.00	4.17	15.00	14.17	16.67	
		IPBL	0.00	2.50	17.50	13.33	16.67	
	Pharmacy	UPBL	0.00	2.50	17.50	13.33	16.67	
		IPBL	0.00	1.67	18.33	14.17	15.83	
3-2. In order to participate more effectively in the discussion, I should acquire further knowledge to find evidence to support my opinion	Clinical medicine	UPBL	0.00	1.67	11.67	8.33	28.33	0.2991
		IPBL	0.00	2.50	9.17	8.33	30.00	
	Nursing	UPBL	0.00	1.67	12.50	9.17	26.67	
		IPBL	0.00	1.67	7.50	11.67	29.17	
	Pharmacy	UPBL	0.00	0.83	13.33	12.50	23.33	
		IPBL	0.00	1.67	10.83	10.00	27.50	
3-3. I can acquire learning objectives more smoothly through case discussions	Clinical medicine	UPBL	1.67	1.67	15.00	12.50	19.17	<0.001
		IPBL	0.00	2.50	4.17	20.83	22.50	
	Nursing	UPBL	0.83	3.33	17.50	12.50	15.83	
		IPBL	0.83	2.50	4.17	21.67	20.83	
	Pharmacy	UPBL	1.67	4.17	15.83	10.83	17.50	
		IPBL	0.00	1.67	6.67	22.50	19.17	
3-4. I will become more adept at gathering information from multiple channels and I can evaluate the value of this information more objectively	Clinical medicine	UPBL	0.00	2.50	25.00	13.33	9.17	<.0001
		IPBL	0.00	3.33	9.17	19.17	18.33	
	Nursing	UPBL	0.00	4.17	24.17	15.83	5.83	
		IPBL	0.00	3.33	3.33	22.50	20.83	
	Pharmacy	UPBL	0.00	2.50	24.17	13.33	10.00	
		IPBL	0.00	2.50	5.83	21.67	20.00	

Contd...

**Table S1: Contd...**

Subscales/statements	Professional	Group	Percent rating (%)					P
			SD	D	N	A	SA	
3-5. Shared learning will increase my ability to express and communicate	Clinical medicine	UPBL	0.00	5.83	16.67	19.17	8.33	<0.01
		IPBL	0.00	4.17	8.33	20.83	16.67	
	Nursing	UPBL	0.00	5.00	15.00	22.50	7.50	
		IPBL	0.00	5.00	3.33	25.00	16.67	
	Pharmacy	UPBL	3.33	4.17	15.83	17.50	9.17	
		IPBL	0.00	3.33	9.17	23.33	14.17	
3-6. After group discussion, my ability to analyze and solve problem was improved	Clinical medicine	UPBL	0.00	3.33	20.83	14.17	11.67	<.0001
		IPBL	0.00	5.00	7.50	22.50	15.00	
	Nursing	UPBL	0.00	5.83	22.50	18.33	3.33	
		IPBL	0.00	1.67	4.17	25.83	18.33	
	Pharmacy	UPBL	0.00	4.17	21.67	14.17	10.00	
		IPBL	0.00	2.50	3.33	28.33	15.83	

SD=Strongly disagree; D=Disagree; N=Neutral; A=Agree; SA=Strongly agree